Smart Helmet

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Project Description

- Client: Dr. Hesam Moghaddam
- Based on Client Requirements Team will use:
  - Laser Sensors, Linear and Angular Accelerometer
  - Bluetooth Transmitter, Memory Card
- Implement for wide range of helmets
- Focus on improving the safety

CAD Models

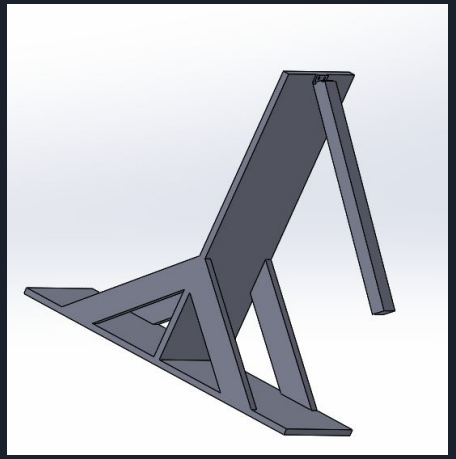

Figure 1: Testing Apparatus

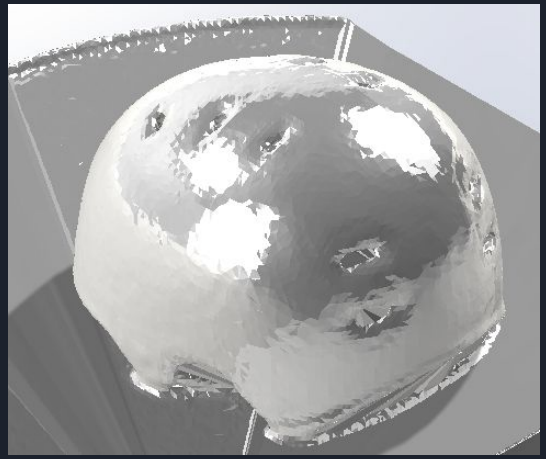

Figure 2: Scanned Helmet Shell

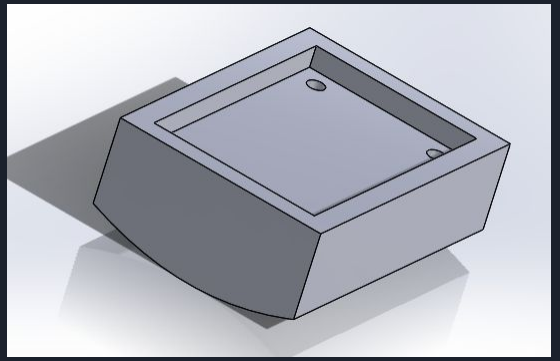

Figure 3: Arduino Inner Mount

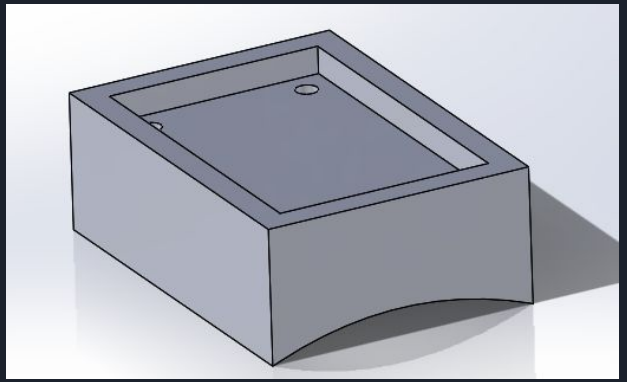

Figure 4: Arduino Laser Mount

Current State Of Project

Figure 5: Testing Apparatus

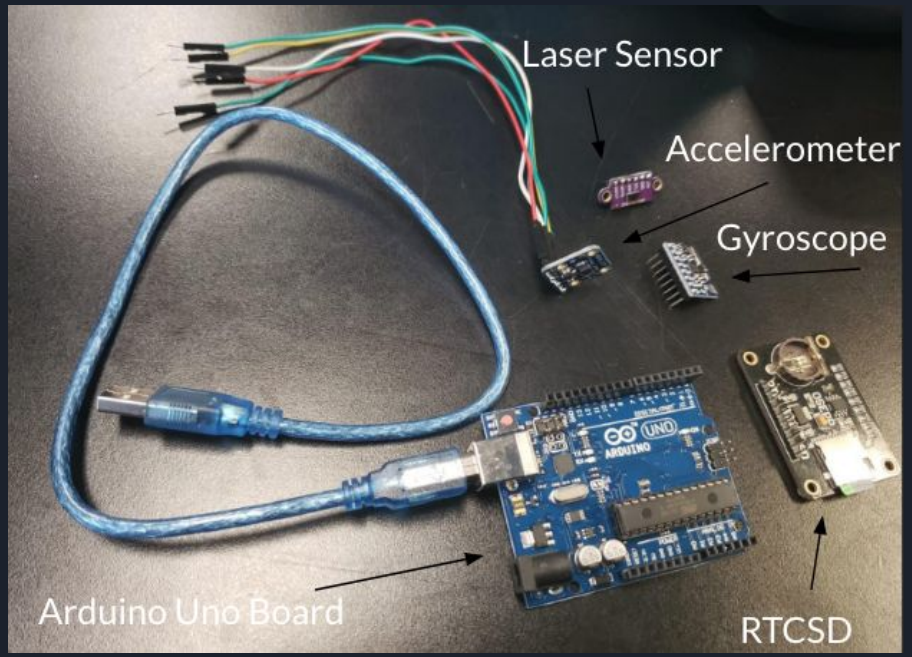

Figure 6: Current Arduino System

Current State of Project Continued

Figure 7: Helmet Shell With D30 Material

Update Accomplishments

- Arduino codes
- Laser sensor
- Gyroscope sensor
- Bluetooth and SD card
- D3O material
- Testing device

Update Changes

Accelerometer

- Linear Acceleration
- Changed due to g-forces

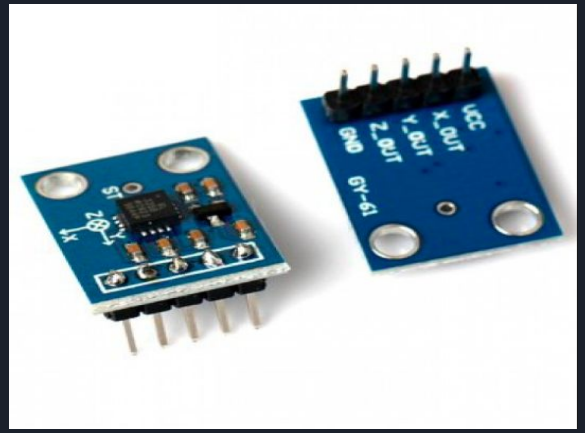

Figure 8: Arduino Accelerometer

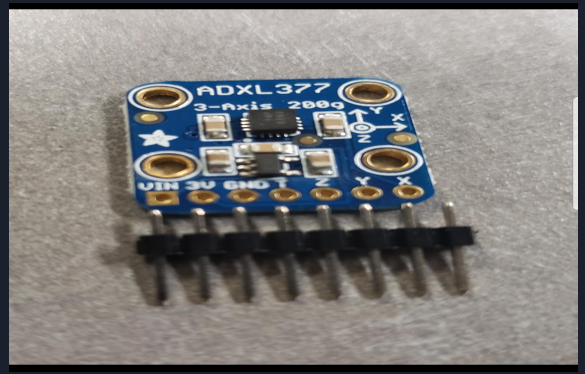

Figure 9: New Accelerometer

Update Changes

Gyroscope

- Gyroscope and Accelerometer
- Angular acceleration
- Detect a quick rotation
- Changed due to safety

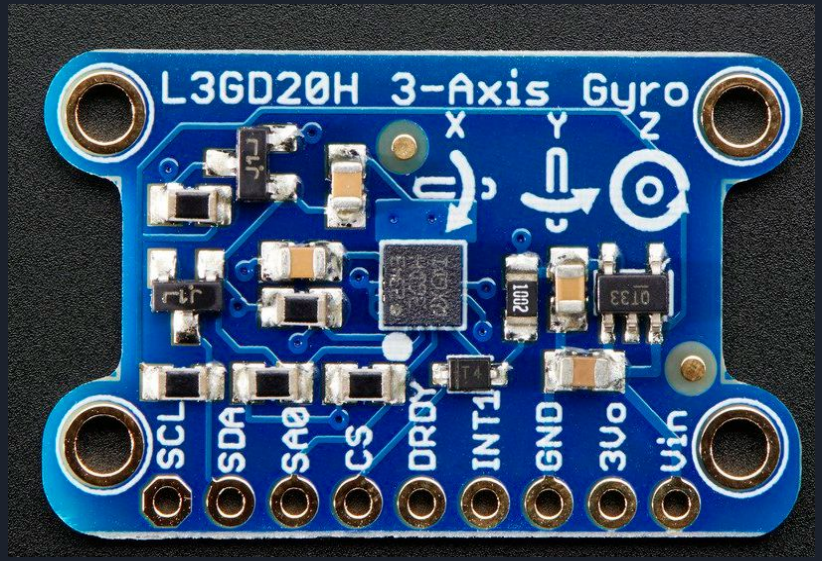

Figure 10: Gyroscope

Update Changes

- D3O material changed due to quality issue

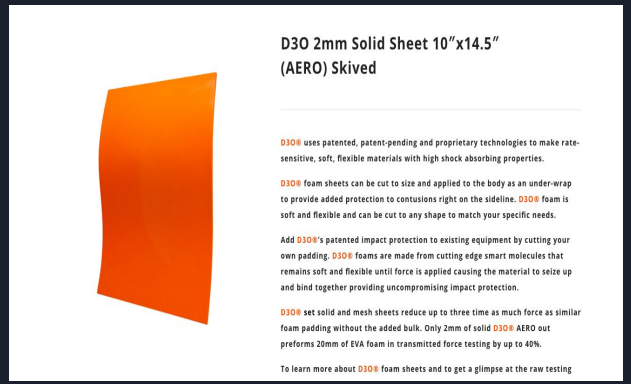

Figure 11: 2mm Sheet

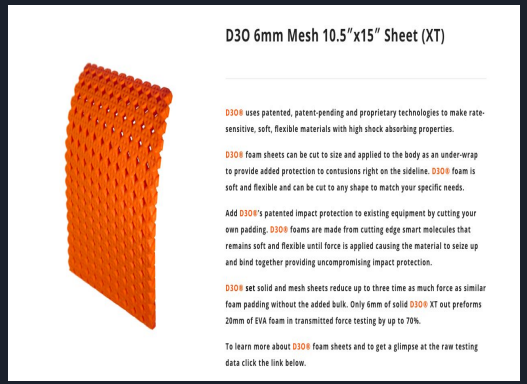

Figure 12: 6mm Sheet

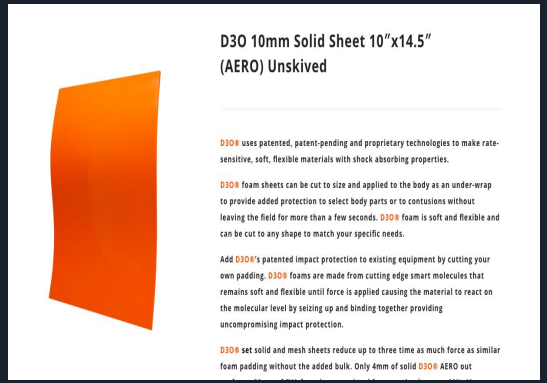

Figure 13: 10mm Sheet

Update Changes

- Ultrasonic changed to laser sensor
- Laser sensor gives more accurate data than Ultrasonic

Figure 14: Ultrasonic

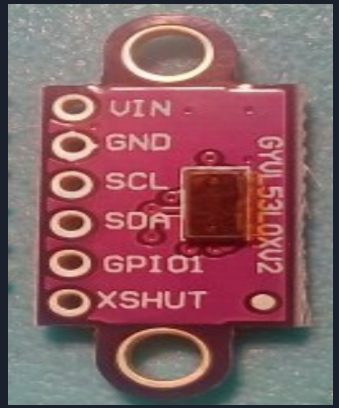

Figure 15: Laser Sensor

Update Changes

- Bluetooth and SD Card
- Identify which sensor is better

Figure 16: Bluetooth

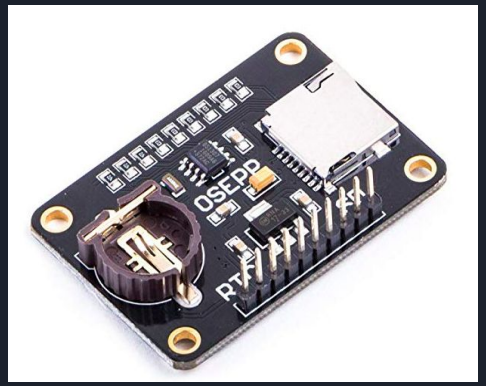

Figure 17: SD Card

Moving Forward

- Analytical Analysis
  - Omar: Buckingham Theorem, Impulse Equation
  - Titus: Angular Acceleration

Moving Forward

- Fares: Testing Laser Sensor Range
- Mana: ASTM Testing Procedure

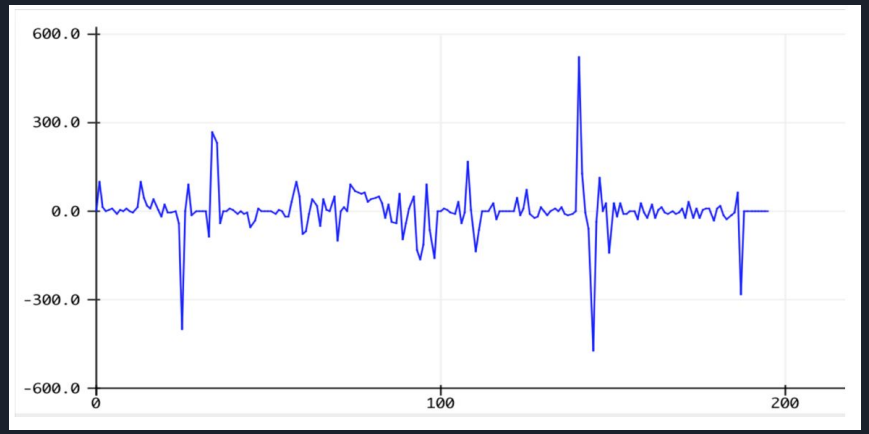

Figure 18: Graph results

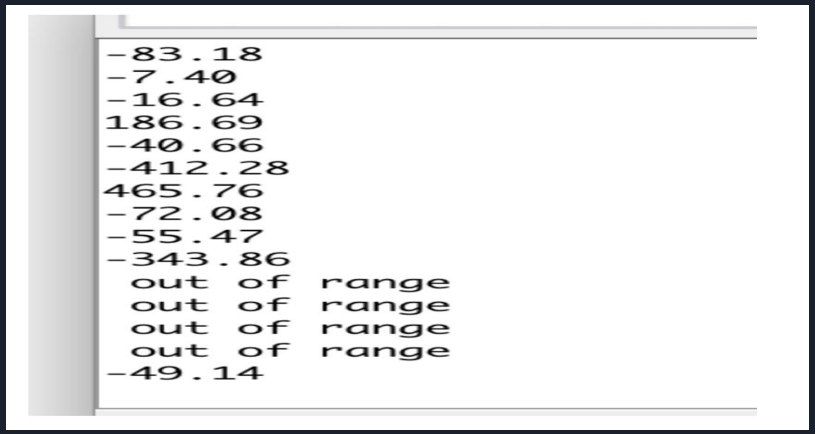

Figure 19: Data results

Moving Forward

- Race: Transmission of data, Bluetooth, Xbee, Wifi

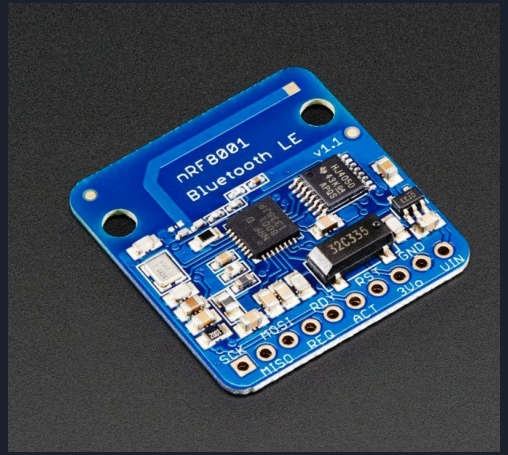

Figure 20: Bluetooth Low Energy Breakout Board

Manufacturing and Testing

- Team will work understanding the code and plan out wiring for the various sensors
- Compile the code for the various parts
- Combine arduino parts into a complete system
- Mount arduino system to helmet
- Mount helmet to testing device to validate sensors
- Finish mounting padding to helmet shell
- Compare the D30 material to other padding materials

Budget

Table 1: Current BOM

Part #	Component Description	Quantity	Cost $	Ref.
1	Testing Helmet	1	19	[1]
2	Viscoelastic	1	30	[2]
3	D3O	2	127.6	[3]
4	Laser Sensor Arduino	1	13.93	[4]
5	Laser Sensor VL53L0X	1	3.56	[5]
6	Data Memory	1	19.99	[6]
7	RTCSD-01	1	17.95	[7]
8	Bluno Bee (Bluetooth Arduino)	1	9.9	[8]
9	Triple-Axis Accelermeter 8g	1	7.95	[9]
10	Xbee Shield	1	9.9	[10]
11	Arduino Uno	1	19.99	[11]
12	Accelermeter 3- Axis sensor 200g	1	24.95	[12]
13	Triple- Axis Gyroscope	1	12.5	[13]
14	Mannequin Head	1	5.29	[14]
15	Wood	4	28.03	Home Depot
16	Arduino	1	60	[15]
		Total	410.54	

Schedule Of Spring 19

Task Name	Start	Finish	Assigned To	Duration
Plan of Spring 19	01/20/19	03/01/19		31d
Website check 1	01/20/19	02/01/19		11d
Hardware review 1	02/18/19	02/22/19	All	5d
Indv. Analysis	02/26/19	03/01/19	All	4d
Midpoint Presentation	03/08/19	03/12/19	All	3d
Hardware review 2	03/29/19	03/29/19		1d
Midpoint report	03/05/19	03/08/19	All	4d
Website check 2	03/29/19	03/29/19		1d
Final product testing proof	04/12/19	04/12/19		1d
UGRADS practice	03/10/19	03/10/19		1d
Operation Manual and Assembly	04/26/19	04/26/19		1d
UGRADS	04/23/19	04/23/19		1d
CAD Package	05/03/19	05/03/19		1d
Final Report	05/03/19	05/03/19		1d
Website Final Check	05/07/19	05/07/19		1d
Staff meeting 19	01/24/19	02/28/19		25.042d
Staff meeting 1	01/24/19	01/24/19		20m
Staff meeting 2	01/31/19	01/31/19		20m
Staff meeting 3	02/07/19	02/07/19		20m
Staff meeting 4	02/14/19	02/14/19		20m
Staff meeting 5	02/28/19	02/28/19		20m
Staff meeting 6 (Team meeting)	02/28/19	02/28/19		20m
Staff meeting 7	03/07/19	03/07/19		20m
Group Meeting 19	01/22/19	01/29/19		5.156d
Team Meeting 1	01/22/19	01/22/19		1h
Team Meeting 2	01/29/19	01/29/19		1h 15m
Team Meeting 3	02/10/19	02/10/19		1h 30m
Team Meeting 4	02/12/19	02/12/19		2h
Team Meeting 5	02/17/19	02/17/19		1h 20m
Team Meeting 6	02/28/19	02/28/19		2h
Team Meeting 7	03/05/19	03/05/19		1h 30m

Figure 21: Current Schedule

Conclusion

- Location of Sensors
- New padding
- Testing
- Budget

References

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